# UNIVERSAL EQUIPMENT CLAMP

## FIELD OF THE INVENTION

The present invention relates to clamps. In a particular form the present invention relates to clamps that are capable of being attached to supporting members of variable shape, orientation and cross-sectional area.

## BACKGROUND OF THE INVENTION

This invention relates to a conceptually simple mechanical device known as a clamp that can be used to attach a device, itself fixed to the clamp, to a supporting member. The attached device can have one or many uses and to some degree the use made of the attached device will determine the type of fixing used to locate the device in its most convenient position.

Clamps are often used for this type of task, as are clamp-like brackets and fixed brackets.

A device that does not need to be subsequently moved can be permanently fixed using a bracket. Such brackets typically need a tool to loosen the device so that it can be repositioned to another similar bracket or removed.

The use of a clamp-like bracket can provide the convenience of a clamping mechanism, which will reduce the time to fix the device and clamp into position when compared to the time it takes to permanently fix a bracket. However, even these arrangements are not ideal, as a bracket adapted to accommodate the device is not always conveniently located for ease of use of the device. However, the variable adjustment aspect of a clamp mechanism can be useful to adapt the clamp-like bracket to a supporting member that is of variable dimension or shape. In most cases, however, the variable adjustment clamping mechanism is used only once at the time of fixing.

In both of the above cases, the device is likely to be permanently fixed in location.

The manner in which the device is attached to the bracket or clamp-like bracket will also determine the amount of variability in orientation the device can have during its use. By way of example, it is possible to provide a pivotable connection, between the device and the bracket. If the device is a monitor screen, it can then be orientated to face towards any desired direction for observation during the use of the monitor. The orientation is, of course, limited by the mechanics of the pivot mechanism.

In many circumstances, this arrangement is adequate, as the monitor remains in the same physical location but can be orientated as required.

However, there are certain types of devices that need to be physically relocated while also needing to be orientated for convenient use and re-orientated as required during further use. In some further cases, the equipment needs to be quickly moved from one location to another.

One example is the use of a sphygmomanometer (blood pressure measuring device) that can be shared between a number of beds in the same ward. Most hospitals overcome this potential inconvenience by installing a sphygmomanometer adjacent to each patient's bed. However, this is only possible because of the relative cheapness of such a medical device and this principle of employing individual devices for each bed cannot be applied to very expensive medical monitoring equipment.

Accordingly, there exists a need for a fixing or clamping mechanism that is attached to a device that is capable of being removably fixed or clamped to a variety of frame members having variable size and shape. It is also considered desirable that the fixing and release of this mechanism be simple and quick.

**SUMMARY OF THE INVENTION**

Accordingly in one aspect the present invention provides a clamp including:

two opposing jaws located with respect to each other so as to be pivotally engaged at adjacent ends,

biasing means arranged to provide a separating bias to separate the free ends of said jaws apart,

at least one threaded rod extending between said jaws wherein said rod is pivotally engaged to one of said jaws intermediate the ends thereof, and wherein said rod passes through said other jaw, said rod further having at a free end a threaded portion extending the length of movement of said jaws towards each other, and

a stop rotatable along said threaded portion so as to adjust the separation between said free ends of said jaws by resisting the outward movement of said opposing jaws due to said separating bias.

As the arms of the clamp are biased open, the clamp is easily and rapidly able to be fitted over different supporting members having varying size and shape. Given that the clamping force is provided by the combination of the threaded rod and rotatable stop, the location of this arrangement along the jaws provides an important mechanical advantage which ensures that the clamp is able to effectively grip a supporting member.

Preferably, at least one opposing jaw includes a gripping portion, said gripping portion including a first gripping surface having a first profile adapted to engage support members of varying size and shape. By modifying the profile of the first gripping surface the ability of the clamp to grip support members of varying size and shape is improved.

Preferably, said gripping portion further includes a removable insert, said insert adapted to be positioned adjacent with said first gripping surface to provide a variable gripping depth between said opposing jaws. By removing the insert, larger support members may be gripped as the distance between the jaws is extended.

Preferably, said insert further includes a second gripping surface, said second gripping surface having a second profile adapted to engage support members of varying size and shape that are smaller then those support members engaged by said first gripping surface. By customising the profile of the second gripping surface to accommodate smaller support members the adaptability of the clamp is greatly enhanced.

Preferably, said gripping portion is formed from elastomeric material. Preferably, said insert is formed from elastomeric material. Preferably, said elastomeric material is neoprene.

Preferably, said rotatable stop includes a knob that has two regions along its length wherein a first region provides a surface shape adapted for being manually turned to provide a high torque to open or close said jaws and a second region provides a surface shape adapted for being manually turned to provide relatively lower torque to open or close said jaws.

This further improves the ease of use of the clamp as often the clamp will be required to be rapidly opened or closed when being remounted to a different support member. Once the clamp has been relocated and closed about the support member, an effective gripping force can be applied by using the high torque region of the knob to close the jaws.

Preferably, said first region includes a pair of opposed wings centred about the axis of rotation of said knob. Preferably, said second region includes a substantially hemispherical domed portion centred about the axis of rotation of said knob.

Preferably, said biasing means is a leaf spring, said leaf spring having opposed arms each engaging an opposing jaw to provide a separating bias.

Preferably, an outer surface of a jaw is adapted for non-slip engagement with a substantially flat surface wherein said non-slip surface is located substantially opposite the location of said stop on said other jaw. This allows the clamp to also be used as a stand.

Preferably, said clamp further includes mounting means for mounting of a device, said mounting means located adjacent to said bias means and wherein said mounting means provides a pivotable connection between said clamp and said mounted device.

**BRIEF DESCRIPTION OF THE DRAWINGS**

A preferred embodiment of the present invention will be discussed with reference to the accompanying drawings wherein:

FIGURE 1 is a perspective view of the clamp according to a preferred embodiment of the present invention with the jaws open;

FIGURE 2 is a central longitudinal cross-sectional perspective view of the clamp illustrated in Figure 1 with the jaws open;

FIGURE 3 is an off-centre longitudinal cross-sectional perspective view of the clamp illustrated in Figure 1 with the jaws open;

FIGURE 4 is a lateral cross-sectional view of the clamp illustrated in Figure 1 along the rod that extends between the jaws of the clamp;

FIGURE 5 is a perspective view of the clamp illustrated in Figure 1 with the jaws closed;

FIGURE 6 is a central longitudinal cross-sectional view of the clamp illustrated in Figure 1 with the jaws closed;

FIGURE 7 is an off-centre longitudinal cross-sectional perspective view of the clamp illustrated in Figure 1 with the jaws closed;

FIGURE 8 is a side view of the clamp illustrated in Figure 1 showing the non-slip area on the outer surface of a jaw of the clamp;

FIGURE 9 depicts the use of the clamp illustrated in Figure 1 located on frame members of different orientation and size; and

FIGURE 10 depicts the use of the clamp illustrated in Figure 1 as a stand for a device such as a monitor.

In the following description, like reference characters designate like or corresponding parts throughout the several views of the drawings.

**DESCRIPTION OF PREFERRED EMBODIMENT**

The invention is described by way of a single preferred embodiment and, for ease of reference, a single application. It should be noted, however, that the particular arrangements of the elements of the clamp are depicted by way of example only and that there may exist one or more mechanical alternatives for those elements. The invention is also depicted having a particular use to support a device namely a computer monitor of the flat screen type, however, this is but one of innumerable uses.

The uses described in this specification are depicted in Figs. 9 and 10, wherein Fig. 9 depicts the clamp allowing the monitor to be mounted to a range of frame members that are of different dimensions and at different angles. Once the clamp is attached to the frame member, the pivotable connection between the clamp and the monitor allows the monitor to be angled to suit the user. Typically, this means that the horizontal axis of the monitor is set to the horizontal and the flat plane of the monitor is set for ease of viewing by the user of the monitor at an appropriate angle to the vertical.

The ability of the monitor to be set and subsequently maintain a desired angle in three degrees of freedom is achievable with the use of a suitable pivotable connection of the ball joint type located between the monitor 210 in the examples shown in Figs. 9 and 10 and the clamp 10. The ball type joint mechanism can be tensioned to fix the position of the monitor or merely hold it in position but allows subsequent movement to another position. However, it should be noted that the pivotable connection is not an essential element of the clamp.

Referring to Fig. 1, the clamp 10 is depicted in perspective with opposing jaws 12 and 14 in an open state. The jaws 12, 14 are shown at their maximum separation from each other as is also depicted in Figs. 2 and 3.

A rod 16 is shown located at the approximate mid-point of the length of the jaws 12, 14. The rod extends between the jaws 12, 14, however, not shown in this figure, the rod 16 is pivoted at one end within jaw 12 and passes through an aperture in jaw 14. A threaded end of the rod 16 terminates inside an internally threaded stop having the form of a knob 18.

The adjacent ends of the jaws 12 and 14 are pivotably connected to an end block 20 and the jaws 12, 14 are biased apart by a spring element 22 as well as being engaged with respective gears on each jaw, so as one jaw moves so does the other. Thus, as knob 18 is turned, it rotates and translates along the length of the rod 16. If the translation is towards the pivotable end of the rod 16 the jaws 12, 14 are moved towards each other aided by the geared engagement. The rotation of the knob 18 closes the jaws 12, 14 if the knob 18 is screwed far enough along the length of the thread provided on the rod 16.

The inner surfaces of the jaws 12, 14 comprise a two-part construction, shaped so as to provide the ability to clamp to a wide variety of members having various cross-sectional sizes and shapes (outer diameters may vary as well as their shape). Further, the material of the inner surfaces is formed from an elastomeric material so as to assist the gripping function on to various shaped members.

Clamp 10 can also be used as a stand for the device it is attached to, in which case, the resting foot of the stand is provided by the outer surface of jaw 12. A non-slip surface 24 is incorporated into jaw 12 to assist this function. Fig. 10 depicts this particular function. In this embodiment, the non-slip surface is a rubber pad 24.

Referring to Fig. 2, clamp 10 is depicted in perspective and in central longitudinal cross-section with opposing jaws 12 and 14 in an open state.

A rod 16 is shown extending between a pivot 26 located in jaw 12 to a knob 18 shown located on the underside of jaw 14. The cavity 28, in which the pivot resides, is sized so as to allow the pivoted end of the rod to move from side to side, enough so that jaw 12 can move away from and towards jaw 14 unrestricted by the body of the jaw. Similarly, the aperture 30 in jaw 14 is sized to allow the rod 16 to move within the aperture in an unrestricted fashion while jaw 14 moves away from and towards jaw 12.

Not shown, is a thread along the end of the rod 16, that is the end opposite the pivot 26. A matching thread is located inside the knob 18. As knob 18 is turned in a clockwise direction (as determined from a view above the knob), knob 18 translates along the length of the rod 16 and, at the same time, the rod 16 is drawn to the inside of the knob 18. There is a semi-hemispherical shape 32 on the bottom of the knob 18, which rests in a concave hollow 70 in the top surface of jaw 14. The hollow 70 preferably conforms to the semi-hemispherical shape 32.

The surface of concave hollow 70 performs two functions:

- it allows jaw 14 to move relative to the knob 18 with minimal friction against the rotational movement of the knob 18, and
- it allows there to be maximisation of the closing force of the knob 18 against the jaws, in particular jaw 14.

The knob 18 is provided with two regions of different shape. The winged bottom portion 34 comprises two wing-like protrusions on opposite sides of the body of the knob 18. This portion allows the user of the clamp 10 to make half turns of the knob 18 using high torque because of the leverage provided by the distance of the ends of the wings 34 from the central longitudinal axis of rotation of the knob 18.

The pointed top portion 36 of the knob 18 comprises a gradually domed conical shape. This portion of the knob 18 allows the user of the clamp 10 to make rotations of the knob 18 using smaller torque than available from the winged portion 34 but which can effect quick adjustments to both open or close clamp 10. A user will likely use their thumb and forefinger to twirl the knob 18, at the rate desired, typically to quickly open the jaws 12, 14 before placing the clamp over the support member to be used. The user will then quickly close the jaws 12, 14 until some resistance is met as the jaws 12, 14 clamp more firmly about the support member. The user applies the final and firmest clamping force by rotating the knob 18 using the wings 34 on the lower portion of the knob 18.

The jaws 12, 14 are made from identical moulds, which assists to keep costs down. A consequence of this approach is that the cavity 28 is the same as the aperture 30. It will also be noted that the concave depression in jaw 14 is also in jaw 12 but covered over by rubber pad 24 which requires two more apertures to be formed in jaw 12 to accommodate the capture posts 24a and 24b of pad 24.

In Fig. 2 the end block 20 is shown in greater detail than shown in Fig. 1 and in particular, shows the pivot construction comprising apertures 38 and 40 for the positioning of pins (not shown) that protrude from at least one inner side of the jaws 12, 14. In this preferred embodiment, the end block 20 is shown as having a ball joint shaped pivotable connection 42. The means of attachment of the ball joint housing to the device is not shown, but consists of a three-point screw arrangement.

Referring to Fig. 3, there is shown a cross-section along the length of the clamp 10 slightly offset from its mid-line, so as to show further features of the clamp construction.

Leaf spring 22 is employed to provide a separating bias to bias opposing jaws 12, 14 apart. Opposed arms of leaf spring 22 are housed in respective cavities located internal to jaws 12, 14. In the preferred embodiment it has been found that a 10-degree bias is preferable. Clearly, as would be apparent to those skilled in the art, a coil spring or a bent rod or other mechanical equivalent could alternatively be used to provide a bias arrangement suitable to apply a separation force at all times whether the jaws are open or closed. It would also be possible to provide a coil spring between the jaws that is compressed at the time it is installed and therefore inclined to provide a bias for separating the jaws.

The adjacent ends of each jaw 12, 14 are shown as engaging each other. The engagement is provided by gear elements 46 and 48. These assist the opposing jaws 12, 14 to reciprocate their movement one to the other and ensure substantially equal rotational movement about their respective pivots 50 and 52.

The inside surfaces of each jaw include a gripping portion 56 further incorporating a removable inset 54. By reference to jaw 12, gripping portion 56 abuts the ribbed internal shape of jaw 12 so as to provide an outer facing first gripping surface having a profile or contour 58 that can accommodate a variety of support member cross-sectional shapes and sizes. To accommodate support members of smaller shapes and sizes, removable insert 54 fits into the profile 58 of gripping portion 56 and incorporates a second gripping surface having a relatively shallow depth profile or contour 60.

The first gripping surface with relatively deep profile or contour 58 is also shaped for the purpose of accommodating round as well as square cross-sectional shapes, as is to a degree, the second gripping surface with profile 60. The shape shown has also been found to accommodate non-square and non-round support members.

Clamp 10 as mentioned previously, can be used in a hospital environment as the particular size and shape of the inserts are designed to accommodate most of the support members that exist in such an environment. Examples of common clamping points are bed rails and posts, patient trolleys, wheeled hanging posts, tables and benches as well as operating room dollies for large moveable equipment.

The gripping portions 56 and inserts 54 are preferably made of elastomeric or rubber like material, and in preference, they are made of neoprene rubber which has the suitable hard wearing characteristics required for this application.

Gripping portion 56 is arranged to have grooves in locations that match the reinforcing ribs inside the jaw bodies and tabs that insert into reciprocal grooves in the jaw bodies so as to secure the gripping portion 56, but allow it to be removed and replaced as required. Insert 54 can have one or more tabs that insert into reciprocal apertures in the inner surface of profile 58 of gripping portion 56 so as to secure the insert 54 but allow it to be removed and replaced as required. Optionally barbs on the tabs can add additional attachment force when combined with the use of suitably shaped tabs and grooves.

As would be apparent to those skilled in the art, the principle of incorporating inserts can be applied multiple times with different interleaved layers having regions of varying profile adapted to engage support members having different shapes and sizes. In addition this arrangement could be incorporated into one or both arms as is required by the given application of the clamp.

Like elements in the previous figures are depicted in Fig. 4, which shows a lateral cross-section along the rod 16 of the clamp 10 in a closed state.

Fig. 5 depicts a perspective view of clamp 10 with the jaws closed showing a space 100 between opposite inserts 54 that will accommodate the smallest diameter of support member capable of being clamped to.

Fig. 6 depicts a central longitudinal cross-sectional view of the clamp 10 with the jaws closed.

Fig. 7 depicts an off-centre longitudinal cross-sectional perspective view of the clamp 10 with the jaws 12, 14 closed. In particular, the gears 46, 48 at the substantially adjacent ends of the jaws 12 and 14 are fully enmeshed.

Fig. 8 depicts a side view of clamp 10 showing the non-slip pad 24 on the outer surface of jaw 12 of the clamp 10.

Fig. 9 depicts the use of a clamp 10 according to the invention on frame members 200 that may be of different orientation and size and still be accommodated in clamp 10. Once clamped, the universal joint 42 allows a monitor 210 to which it is attached to be orientated to a variety of positions to suit the user of the monitor 210.

The clamp 10 is attached by opening the jaws 12, 14 quickly, this being an especially important requirement in the high-pressure hustle and bustle in an environment such as a hospital. Turning the top portion 36 of the knob 18 between the thumb and forefinger quickly opens the jaws 12, 14 of the clamp 10. The jaws 12, 14 are also separated by the bias means 22, as the knob 18 translates along the length of the rod 16 to a separation distance that will allow the free ends of the jaws 12, 14 to pass around the selected support member 200. The thumb and forefinger then turn the knob 18 in the opposite direction, at least initially quickly using the top portion 36 of the knob 18, until the clamping tension builds and final tightening can be effected using the lower winged portion 34 of the knob 18.

The combination of the elastomeric gripping portions 56 and inserts 54 and the pressure provided by the knob 18 on the jaws 12, 14 of the clamp 10 ensure that the combined weight of the clamp 10, universal joint and attached device do not slip off or rotate on the support member 200 whatever orientation that member may have. The device is then positioned to suit the user's requirements almost regardless of the clamp orientation assisted by the pivotable connection disclosed in this embodiment in use with clamp 10.

There are some limitations of movement caused by the configuration of the universal joint 42. The housing for the ball joint is particularly shaped to allow the post protruding from the ball to slide into a slot 62 (Figs. 1, 3, 4 and 5) that allows the clamp 10 to lay against the rear of the device. This position of the clamp 10 is used when the device is stored or while it is being moved to another location.

Fig. 10 depicts the use of the clamp 10 as a stand for a device such as a monitor 210. In this example, the base of the device attached to the clamp is located on, preferably, a flat surface 215 and the clamp 10 is positioned so that the non-slip pad 24 is also on the flat surface 215. Such an example is illustrated by the need for the user of the monitor 210 to shift from a position next to a bed, to a work desk for administrative purposes or to a bed side table if no suitable support members are conveniently located.

Although a preferred embodiment of the present invention has been described in the foregoing detailed description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the scope of the invention as set forth and defined by the following claims.